



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

Address: COMMISSIONER FOR PATENTS

P.O. Box 1450

Alexandria, Virginia 22313-1450

www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/540,833	06/23/2005	Hiroynki Sato	4007561-173521	2138
23570 7590 04/04/2011 PORTER WRIGHT MORRIS & ARTHUR, LLP INTELLECTUAL PROPERTY GROUP 41 SOUTH HIGH STREET 28TH FLOOR COLUMBUS, OH 43215				
EXAMINER				
LOEWE, ROBERT S				
ART UNIT		PAPER NUMBER		
1766				
MAIL DATE		DELIVERY MODE		
04/04/2011		PAPER		

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/540,833

Applicant(s)

SATO ET AL.

Examiner

ROBERT LOEWE

Art Unit

1766

Period for Reply -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 March 2011.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 5, 7, 10-13, 17 and 18 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 5, 7, 10-13, 17 and 18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-940)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 3/2/11 has been entered.

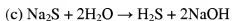
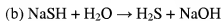
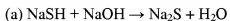
Response to Arguments

Applicant's arguments/remarks, filed on 3/2/11, have been fully considered. A new prior art rejection is now relied upon which replaces the previously relied upon prior art rejection of claims 5, 7, 10-13 and 17-19 to Miyahara et al. (US Pat. **5,840,830**). The new prior art rejection is based on Miyahara et al. (US Pat. **5,744,576**). While the Examiner is relying on a new reference for the rejection of the instant claims, many of the arguments made by Applicants are still applicable to the new rejection and will be addressed.

Applicants argue that by using the claimed alkali metal hydrosulfide and alkali metal hydroxide as starting materials instead of an alkali metal sulfide, an unexpected reaction occurs between the alkali metal hydroxide and the organic amide solvent in the dehydration heat treatment to form an alkali metal alkylaminoalkanoate, and the alkali metal hydrosulfide exists in the system in the form of a complex with the alkali metal alkylaminoalkanoate. However, it is known to employ such alkali metal alkylaminoalkanoates as starting materials in the field of PPS preparation. Specifically, Edmunds, Jr. et al. (US Pat. 4,324,886) and Campbell (US Pat. 3,867,356) teach the reaction of organic amides [including N-methylpyrrolidone (NMP) the preferred solvent in both the instant application and Miyahara] with sodium hydroxide (the preferred alkali metal hydroxide in both the instant application and Miyahara) to afford sodium N-methyl-4-aminobutyrate (example III of Edmunds and example IV of Campbell). Campbell further teaches that improved molecular weights and yields are obtained when employing sodium bisulfide (also called sodium hydrosulfide, NaSH) and sodium N-methyl-4-aminobutyrate as starting materials as compared to employing sodium hydrosulfide and NMP as starting materials (Examples I and II). Therefore, it is believed that (1) the reaction between an alkali metal

hydroxide and the organic amide solvent to produce and alkali metal alkylaminoalkanoate, and (2) the improvement in melt viscosity when the polymerization is conducted in the presence of an alkali metal alkylaminoalkanoate are not unexpected, despite Applicants assertions to the contrary. That is to say, a person having ordinary skill in the art would have expected that a mixture of sodium hydrosulfide/sodium N-methyl-4-aminobutyrate would be present when employing NaOH and NaSH as starting materials to prepare sodium sulfide as suggested by Miyahara et al. (US Pat. 5,744,576). Further, a person having ordinary skill in the art would have expected improved melt viscosities and yields of the PAS produced when using NaOH and NaSH as starting materials, instead of Na₂S as starting material.

Applicants further argue that if a person having ordinary skill in the art employed NaOH and NaSH as starting materials as taught by Miyahara et al. (US Pat. 5,744,576) in lieu of employing Na₂S as exemplified by Miyahara et al. (US Pat. 5,744,576), the person of ordinary skill in the art would be faced with at least three chemical reactions:



Applicants argue that a person having ordinary skill in the art would not have known the extent to which each of the above reactions would occur and whether products other than the intended product would be contained in the reaction vessel and how the presence of these non-intended products would affect the polymerization to produce a PAS. Applicants then argue that one of ordinary skill in the art would normally have feared such byproducts and the detrimental effects they pose on the properties of the final PAS produced. Therefore, Applicants argue, one of ordinary skill in the art would have considered a step of removing the intended sodium sulfide product from the other products produced during the dehydration step. However, Miyahara et al. (US Pat. 5,840,830) explicitly teaches that the amount of hydrogen sulfide (which is the product produced from reactions (b) and (c) which is produced as a byproduct during the dehydration step is typically 2-5% of the total sulfur source used (3:16-27). As such, a person having ordinary skill in the art would be aware of such reactions and the extent that such reactions occur. Therefore, starting with a 1:1 mixture of NaOH and NaSH and losing 2-5% of sulfur source as hydrogen sulfide would give a final NaOH:NaSH ratio of approximately 1.02-1.05,

which satisfies the range claimed by Applicants in step (2) of claim 5. Therefore, it is submitted that the extent to which reactions (b) and (c) occur are in fact known in the art.

Applicants further argue that Miyahara fails to exemplify any process wherein sodium hydroxide and sodium hydrosulfide are employed as reactants as required by the instant claims. However, Miyahara et al. (US Pat. 5,744,576) does disclose this possibility in the specification. A reference may be relied upon for all that it teaches including nonpreferred/non-exemplified embodiments.

Claim Rejections - 35 USC § 103

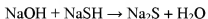
The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 5, 7, 10-13, 17 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Miyahara et al. (US Pat. 5,744,576) as evidenced by Miyahara et al. (US Pat. 5,840,830, referred to as Miyahara A below), and optionally evidenced by Vidaurri, Jr. et al. (US 2002/0183481).

Claims 5 and 18: Miyahara et al. teaches a process for producing a poly(arylene sulfide) by polymerizing a sulfur source and a dihalo-aromatic compound in an organic amide solvent. Miyahara et al. first teaches a dehydration step whereby sodium sulfide and N-methyl-2-pyrrolidone (NMP, an organic amide solvent) are subjected to distillation, removing a part of the distillate containing water (example 1). The hydrogen sulfide gas which forms during this step is taught to be removed from the system. This removal of hydrogen sulfide is directly linked with a weight loss of sulfur in the reaction vessel. While Miyahara et al. employs sodium sulfide pentahydrate as the starting material in the working examples, Miyahara et al. does explicitly

teach that the sodium sulfide can be produced in situ by reaction of sodium hydrosulfide and sodium hydroxide (3:58-61). The reaction between sodium hydrosulfide and sodium hydroxide inherently produces water, therefore, the alkali metal hydrosulfide is present as an aqueous mixture with water as required by instant claim 5. With the suggestion to prepare the alkali metal sulfide in situ, a person having ordinary skill in the art would immediately have found it obvious to employ the alkali metal hydroxide and the alkali metal hydrosulfide in equimolar amounts given the following chemical equation (exemplified using sodium):



Employing the alkali metal hydroxide and alkali metal hydrosulfide in equimolar amounts effectively captures the limitation that the ratio of alkali metal hydroxide to alkali metal hydrosulfide ranges from 0.95-1.02 as required in step (1) of claim 5.

While Miyahara does not teach that during the dehydration step, the alkali metal hydroxide reacts with the organic amide solvent and forms an alkali metal alkylaminoalkanoate, and the alkali metal hydrosulfide forms a complex with the alkylaminoalkanoate as required by claim 19, Miyahara suggests carrying out the dehydration step in the same manner as the instant invention, namely the reaction of NaOH with NaSH in NMP (an organic amide solvent) for the same times and temperatures (6:43-65 and example 1a). That is Miyahara is suggestive of reacting NaOH and NaSH in the same amount of organic amide solvent (NMP) at the same time (3.5 h) and temperature (200 °C) as Applicants preferred embodiments. Therefore, the formation of a sodium hydrosulfide-alkylaminoalkanoate complex would be inherent to the process as suggested by Miyahara et al. Further, Vidaurre, Jr. et al. teaches the preparation of poly(arylene sulfides) and teaches that when an aqueous alkali metal hydroxide is contacted with the polar organic compound (preferably NMP), an alkali metal aminoalkanoate forms and that the alkali metal aminoalkanoate formed is far less corrosive and further has the advantage of being soluble in the polymerization reaction mixture (paragraph 0012). It follows therefore, that the same chemistry would take place in the system of Miyahara et al. since Miyahara et al. teaches the same reaction conditions.

Miyahara et al. further teaches adding water after the dehydration such that the amount of water present ranges from 0.5-2.0, preferably from 1.0-1.9 moles per mole of alkali metal sulfide charged (charged sulfur source), which satisfies the limitation "0.5 to 2.0 moles of (iv) per mol of

the charged sulfur source" of step (2) of claim 5. Miyahara et al. further teaches that in cases where the alkali metal sulfide is decomposed by a dehydration reaction to form hydrogen sulfide, the alkali metal hydroxide formed as a result of such a decomposition may serve as a polymerization stabilizer (5:50-54). It follows that there would be a molar excess of alkali metal hydroxide relative to the charged sulfur source when hydrogen sulfide is discharged from the system (which is the case in all of the examples). Miyahara A teaches that during the dehydration step, the amount of hydrogen sulfide lost generally amounts to 2-5% in terms of the charged sulfur source (which may be the alkali metal sulfide or alkali metal hydrosulfide) (3:16-21). The amount of hydrogen sulfide lost in the working examples of Miyahara et al. amounts to approximately 2% in all three working examples. Given the teachings of both Miyahara references, it is submitted that a person having ordinary skill in the art would have found it obvious to (1) prepare the sodium sulfide in situ using an equimolar amount of alkali metal hydroxide and alkali metal hydrosulfide since this is explicitly taught by the references, and (2) let the alkali metal hydroxide which is formed when hydrogen sulfide exits the system serve as the polymerization stabilizer as taught by Miyahara et al. (5:50-54). Since the amount of alkali metal hydroxide to charged sulfur source prior to dehydration is 1:1 (or approximately 1:1) and since 2-5 % of the sulfur exits the system as hydrogen sulfide, the final ratio of alkali metal hydroxide to charged sulfur source would be approximately 1.02-1.05, which satisfies the limitation "to provide 1.015 to 1.050 moles of (i)-(iii) per mol of a sulfur source" of step (2) of claim 5. As such both ranges in step (2) of claim 5 are fully satisfied by the teachings of Miyahara et al. as evidenced by Miyahara A.

Miyahara et al. further teaches (and exemplifies) a first-stage polymerization step of reacting the alkali metal sulfide with a dihalo-aromatic compound within a temperature range of 170 °C to 270 °C to form a prepolymer at a conversion rate of 70-98 mol% (5:63-6:6). Miyahara et al. therefore effectively anticipates the process limitations corresponding to a first-stage polymerization step (3) of instant claim 5.

Miyahara et al. further teaches a second-stage polymerization step (final polymerization step) in which water is added to the reaction system in such a manner that the water is present in a proportion of 2.1-10 moles per mole of the alkali metal sulfide charged and the reaction is continued at a temperature range of 245-290 °C to continue polymerization (7:60). Miyahara et

al. therefore effectively anticipates the process limitations corresponding to a second-stage polymerization step (4) of instant claim 5. In summary, Miyahara et al. anticipates all of the claimed process steps of instant claim 5. Miyahara et al. exemplifies that the dehydration and subsequent polymerization steps are conducted in the same reaction vessel, which satisfies the limitations of instant claim 5.

The melt viscosities and yellow index of the poly(arylene sulfides) prepared by Miyahara et al. all fall within the claimed ranges of instant claim 5 (examples 1-3). While Miyahara et al. does not explicitly teach the MV2/MV1 ratio of melt viscosity after a reaction with aminosilane as required by instant claim 5, or that the bis(4-chlorophenyl)sulfide content is less than 21 ppm as required by instant claim 18, Miyahara et al. explicitly teaches all of the claimed process steps. Since the poly(arylene sulfide) as taught by Miyahara et al. and Applicant's disclosure are both produced in the same manner, any physical properties achieved by the compositions of Miyahara and the instant application would inherently be the same. A chemical composition and its properties are inseparable. Therefore, if the prior art teaches the identical chemical structure, the properties applicant discloses and/or claims are necessarily present. In re Spada, 911 F.2d 705, 709, 15 USPQ2d 1655, 1658 (Fed. Cir. 1990). See also In re Best, 562 F.2d 1252, 1255, 195 USPQ 430, 433 (CCPA 1977). "Where the claimed and prior art products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical processes, a prima facie case of either anticipation or obviousness has been established." See MPEP 2112.01.

Last, the reaction process which is rendered obvious by Miyahara et al. only requires the use of an alkali metal hydrosulfide, an alkali metal hydroxide, and the dihalo-aromatic compound as reactants in the organic amide solvent as required by instant claim 5.

Claim 7: Miyahara et al. exemplifies that during the dehydration step, that the reaction mixture is heated to a temperature of 200 °C (example 1), which satisfies the limitation of instant claim 7.

Claim 10: Miyahara et al. teaches that the melt viscosity of the prepolymer after the first stage polymerization step ranges from about 0.1-30 Pa·s (as measured at 310 °C and a shear rate of 1,200/sec) (7:54-58), which effectively anticipates the limitation of instant claim 10

Claim 11 : Miyahara et al. further teaches after the second-stage polymerization step, (5) a separation step of separating the polymer from the reaction mixture containing the polymer, and (6) a washing step of washing the polymer thus separated with an organic solvent (example 1), thereby satisfying instant claim 11.

Claim 12: Miyahara et al. further teaches that the separation is achieved by sieving/filtering (8:55-62).

Claim 13: Miyahara et al. further teaches that the organic solvent used in the washing step is acetone (example 1).

Claim 17: While Miyahara et al. does not exemplify a poly(arylene sulfide) having a melt viscosity value of 125-500 Pa·s as required by instant claim 17, Miyahara et al. renders obvious Applicants claimed process. As such, any physical properties which are claimed by Applicants but otherwise not taught by Miyahara et al. would inherently be present.

Correspondence

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ROBERT LOEWE whose telephone number is (571)270-3298. The examiner can normally be reached on Monday through Friday from 7:30 AM to 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Randy Gulakowski can be reached on (571) 272-13021302. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Robert Loewe/
Examiner, Art Unit 1766
23-Mar-11